

Amendments to the Specification

Please replace the paragraph extending from page 6, line 22, through page 7, line 14, with the following amended paragraph:

Referring to FIGS. 3A, 3B, 3C and 4, in one embodiment, the polarization field (ξ_p) has a magnitude that is sufficient to enable tunneling at infinitesimal applied bias. In particular, the polarization field magnitude (together with the dopant-induced drift field, ξ_d) is sufficient to align conduction band states near the Fermi level (EF) at the first heterointerface 18 with valence band states the Fermi level (EF) at the second heterointerface 20. At zero bias (FIG. 3A), the number of as many electrons that tunnel from the conduction band of layer 12 to the valence band of layer 14 is as many as the number of electrons that tunnel in the opposite direction. Therefore, at zero bias, the tunneling current is zero (see point A in FIG. 4). When a relatively small forward bias (V_f) is applied (FIG. 3B), however, the quasi Fermi levels are split by an amount equal to qV_f . There are now a large number of empty states in layer 14 available for electrons to tunnel from the conduction band in the n-doped first semiconductor layer 12. As a result, tunneling current may flow (see point B in FIG. 4). When the forward bias is increased further, the available charge carrier tunneling states do not overlap and no states are available for direct tunneling (FIG. 3C). Under such conditions, the tunneling current drops (see point C in FIG. 4). The subsequent rise in the diode current is related to normal diode conduction mechanisms. Under reverse bias conditions, electrons tunnel from occupied states in the valence band of the p-type second semiconductor layer 14 into empty states of the conduction band of the n-type first semiconductor layer 12. The result is a "leaky" (or backward) diode with a relatively small voltage drop. As shown in FIG. 4, the resulting current-voltage characteristic is similar to that of a conventional tunnel diode. This polarization field enhanced tunnel heterostructure may be used for low-power microwave applications, such as local oscillation and frequency-locking circuits, as well as rectification of small signals, microwave detection, and mixing.

Please replace the paragraph extending from page 7, line 27, through page 8, line 9, with the following amended paragraph:

Referring to FIGS. 5A, 5B and 6, in some embodiments, the polarization field magnitude (together with the dopant-induced drift field) may be insufficient to align an occupied conduction band state at the first heterointerface 18 with an unoccupied valence band state at the second heterointerface 20 at zero applied bias (FIG. 5A). Consequently, such a heterostructure does not exhibit the negative differential resistance that is characteristic of the heterostructure discussed above in connection with FIGS. 3A-4. However, such a heterostructure still may be operated under reverse bias conditions to provide a "leaky" (or backward) diode with a relatively small voltage drop. Thus, as shown in FIG. 5B, only a relatively small reverse bias (V_r) is needed to initiate electron tunneling from occupied states in the valence band of the p-type second semiconductor layer 14 into empty states of the conduction band of the n-type first semiconductor layer 12. As shown in FIG. 6, under small bias conditions, the current in the reverse direction is larger than the current in the forward direction. This polarization field enhanced tunnel heterostructure may be used for rectification of small signals, microwave detection, and mixing.